NC STATE UNIVERSITY

scope

SPRING/SUMMER 2006 A LOOK INSIDE THE COLLEGE OF PHYSICAL AND MATHEMATICAL SCIENCES

Will we have enough scientists for the future?

This high-school student is part of an effort to strengthen the nation's position in science, technology, engineering and mathematics

STEM—Scientists for the nation's future

NC State is speaking out about the advancement of science, technology, engineering and mathematics (STEM).

STEM is the rallying cry for ensuring our nation's future supply of scientists, future competitiveness in the global economy, and future leadership in discovery and innovation.

For several years, scientists and educators have warned that the U.S. was falling behind other nations in these areas. Consider these statistics from the National Science Board, National Science Foundation and recent Senate testimony:

- Half of America's scientists are 40 or older and the average age is rising.
- Fewer students are pursuing STEM degrees. Prospective engineers dropped from 36 percent of high school seniors a decade ago to only 6 percent today. Graduate enrollment in science and engineering has been declining since 1993. In 2000, only 17 percent of American undergraduate degrees were in the sciences, while in China, it was 56 percent.
- Three decades ago, the U.S. produced the third-highest number of science degrees. In 2003, we were 17th.
- If present trends continue, 90 percent of the world's scientists and engineers will be living in Asia by 2010.
- Even if we start today, efforts to reverse these trends will take 20 years to produce results. It takes this long to grow a scientist.

Alarmed? I am.

Our position as a world leader in science and technology is threatened—and perhaps even our national security. We cannot outsource our defense and homeland security needs to foreign countries.

And our economy is in jeopardy. Economists, including Alan Greenspan, have identified scientific and technological progress as the most important factor in U.S. economic growth.

In the global community, we face competition like never before. We are simply not graduating enough students in the sciences for our nation's needs. Meeting these needs is a key goal for new UNC System President Erskine Bowles (page 10).

We must do a better job of recruiting students into STEM disciplines. Our nation has the talent pool—in fact, one congressional report concludes that if women, blacks, Hispanics, Native Americans and persons with disabilities are recruited into STEM careers in proportion to their percentage of our population, our need for more scientists could largely be met. These groups represent about two-thirds of our population, yet produce a disproportionately small percentage of our scientists.

Recruiting more scientists is not going to be easy. Science and Math departments must play a key role in K–12 math and science education. We must encourage students to pursue STEM careers at a very young age, continue to engage them throughout their grade school years, and provide them with an excellent college education. We must provide scholarships, fellowships and other resources to eliminate financial barriers to higher education.

PHOTO BY ROGER WINSTEAD

Dean Daniel L. Solomon

You'll read more about STEM-related topics in this issue of *Scope*. The Science House (page 8), our premier K–12 science and mathematics outreach program, seeks to fill the pipeline of future scientists. One of our faculty members testified on Capitol Hill in support of legislation that would increase basic research funding (page 11).

We've also included a university report on what NC State is doing about STEM—you'll be proud to see many of your College's programs cited (page 12).

We know that as alumni and friends of the College, you will clearly understand the importance of STEM, and we want to keep you informed about our efforts. How can you help? We've included some ideas on page 12.

In the 1960s, the threat of being outdone by Sputnik led to the U.S. putting astronauts on the moon. Working together, we can turn the STEM challenge into an opportunity to inspire our nation to even greater heights.

Daniel L. Solomon, Dean

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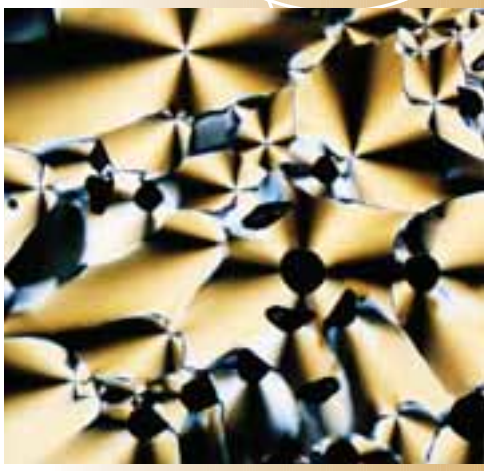
A LOOK INSIDE THE COLLEGE OF PHYSICAL AND MATHEMATICAL SCIENCES SPRING/SUMMER 2006

In this issue...



see page 7

Alumni and Friends Weekend!

PAMS Celebrate Achievement!
October 13–14, 2006

www.pams.ncsu.edu/weekend

see back cover

On the cover: High-school student Jonathan Butler works with a circuit board at The Science House. Photo by Roger Winstead.

Faculty/Staff Notables

Al Riordan (Marine, Earth and Atmospheric Sciences)—Outstanding Extension Service Award

Sharon K. Schulze (The Science House)—Outstanding Extension Service Award

Roger Woodard (Statistics)—NC State Outstanding Teacher Award

Michael Shearer (Mathematics)—NC State Academy of Outstanding Teaching

Mary Higby Schweitzer (Marine, Earth and Atmospheric Sciences)—Alumni Association Outstanding Researcher Award

Moody Chu (Mathematics)—Alumni Distinguished Undergraduate Professor Award

Marie Davidian (Statistics)—2006–08 Executive Editor of *Biometrics*

Bryant, Sall and Williams honored

Before family, friends, faculty and staff, the College honored three individuals at the PAMS Awards Dinner, held earlier this spring at the Cardinal Club in downtown Raleigh.

In addition to honoring the College's 16th recipient of the Distinguished Alumnus Award, this year's dinner featured the premiere of two new awards.

"Because of recent increases in the opportunities for participation by our alumni and friends, we've come to be graced by their dedicated involvement, inspired by their leadership and sincere interest in the success of our students, faculty and programs, and very proud of the distinction their successes bring to the College and the University," said Dean Dan Solomon. "One award was simply not enough."

Meredith J. Williams

Meredith Williams (PhD Physics '94) was honored as the first recipient of the PAMS Medal of Achievement.

This award recognizes alumni of the College who have excelled through their chosen professions or public service, and proven themselves destined to make a significant impact on science, government, education, business or industry.

Williams came to NC State from Yale University, to pursue her PhD in physics. Her service to the College and its students began almost immediately, as she started providing tutoring services for minority students in physics while working toward her doctorate. This involvement has continued since she graduated in 1994, and she frequently returns to campus to provide mentorship for our students.

"Despite being on the other side of the continent, she takes a personal interest in the success of our students," said Solomon in his remarks at the dinner. "I'm told that when we have a minority physics student preparing for their graduate program interview, Meredith will call them and drill them to sharpen their interview skills. She maintains such a high level of participation with our students, that in a very real way, she never left NC State."

Most of Williams' career has been spent at Applied Materials in Santa Clara, California. Her work focused on the engineering and production of some of the most important aspects of microprocessor technology. She also managed the budget and resources for 1,000 employees. She has an impressive publication record and holds six patents.

Williams currently works as an independent consultant to several environmental organizations, and her community volunteer work reveals a passion for the environment. She is a charter member of Wildlife Stewards, a volunteer for the San Francisco Bay Area National Wildlife Refuge Complex, and a San Francisco Baykeeper. She serves on the board of directors for the PAMS Foundation, and is an enthusiastic and valued representative of the College.

"Meredith has achieved prominence in her profession, taken effective advantage of her opportunities, and continues to share her many gifts with her community, this College and its students," Solomon said. "We're very proud of her, and we

PHOTO BY DANIEL KIM

Robert Bryant, Ginger Sall and Meredith Williams were honored at the PAMS Awards Dinner.

at PAMS Awards Dinner

expect even greater things from her in the future."

Virginia B. Sall

Virginia "Ginger" Sall, a longtime champion of the College, was honored as the first recipient of the Zenith Medal for Service.

This award recognizes alumni or friends of the College for distinguished contributions or advocacy that significantly advance our ability to make powerful impacts on science, the economy, the environment and the quality of human life.

Sall has provided advice and counsel on a variety of initiatives, from recruitment techniques for obtaining campaign leaders to ideas for improving our overall communications and involvement strategies for volunteers. It was her idea to feature special academic classes at the College's first Alumni & Friends Weekend last September—classes that turned out to be very popular with participants.

Sall serves as a co-chair of the College's campaign committee. Under her dedicated leadership, the College stands at 97 percent of its $50 million goal, with about two years left in the campaign. Sall helped obtain one of the campaign's leadership gifts, and has hosted key meetings and events for both the College and University.

"Ginger's involvement has been vital to our continued success, and her influence is felt, either directly or indirectly, across the entire College," Solomon said. "As we developed the language describing the award, Ginger Sall's name came up over and over again as a shining example of the qualities we wanted this award to represent."

Sall's community service is hallmarked by her efforts to alleviate extreme poverty and to promote social justice through global health—particularly for mothers and young children. For 25 years, she has been a member of La Leche League International. She served as the organization's board chair in 2000 and 2001, and now represents the organization at the United Nations in New York.

Ginger also serves on the boards of CARE USA and World Wildlife Fund U.S. She is a co-founder of Cary Academy, which has achieved a distinguished reputation as an innovative middle and high school. She also is co-founder and director of the Sall Family Foundation.

Ginger holds a BA in physics from Rice University and studied biostatistics at the School of Public Health at the University of North Carolina.

"Our students and faculty have truly benefited from Ginger's creativity and effective leadership," Solomon said. "Her dedication to education, environmental stewardship and the quality of human life is inspiring."

Robert L. Bryant

Robert Bryant (BS Mathematics '74) was recognized as the 2005 PAMS Distinguished Alumnus, an award which honors alumni whose exceptional achievements in business, education, research or public service have brought honor and distinction to the College of Physical and Mathematical Sciences and North Carolina State University.

"While we are proud of all of our alumni who do well after they leave the university, Robert Bryant is one of those few who reach the pinnacle of their field," Solomon said.

Bryant received his BS in mathematics from NC State in 1974 and his PhD in mathematics at the University of North Carolina at Chapel Hill in 1979. He began his academic career at Rice University as an assistant professor and was later named the Noah Harding Professor of Mathematics. In 1988, he came to Duke University as the J.M. Kreps Professor of Mathematics. His research focuses on nonlinear partial differential equations and differential geometry.

Bryant has excelled in every area in which academic achievement can be measured. He was one of the youngest people to achieve the level of professor at Rice University and was named a Presidential Young Investigator. He has organized regional, national and international conferences, presented about 60 talks, and published scores of papers and six books. He also has held visiting faculty positions at 20 institutions across the U.S. and Europe.

Bryant has served his profession in numerous ways. He is a member of the American Mathematical Society and served on several of its committees, including its executive committee. He has worked as editor or an editorial board member for several professional journals, and is heavily sought as an editorial referee.

His impressive career is highlighted by his service as chair of the board of trustees of the Mathematical Sciences Research Institute in Berkeley, California—an appointment of the highest honor.

An active community member, Bryant has served Duke University through participation in various campus committees, and his community as director of the Chamber Arts Society of Durham and on the board of the Vietnam Education Foundation. He is a member of the Mathematical Association of America and is a Fellow of the American Academy of Arts and Sciences.

Always maintaining a connection to NC State, Bryant is a member of the Chancellor's Circle, and has provided educational support for mathematics students for many years through the John W. Cell Scholarship and the Fund for Excellence.

"We are proud to recognize his many national and international achievements, his leadership at the highest levels of his profession, his spirit of community service and his ongoing support of the College and University," Solomon said.

"Because of recent increases in the opportunities for participation by our alumni and friends, we've come to be graced by their dedicated involvement, inspired by their leadership and sincere interest in the success of our students, faculty and programs, and very proud of the distinction their successes bring to the College and the University."

— Dean Dan Solomon

Physicists produce first images of "nano-sponges"

A team of U.S. and U.K. researchers has obtained the first images of swollen microgel particles in their wet state.

Microgels are microscopic particles that can, under suitable conditions, swell to many times their original volume. This allows them to act like 'nano-sponges,' thus offering potential applications in drug delivery, heavy metal sequestration, sensors, catalysis, dynamically tunable microlenses, water purification, as well as viscosity modifiers and smart particulate emulsifiers.

Imaging these particles in their swollen state is important in understanding their behavior, but they are too small to be visible by either conventional optical microscopy or electron microscopy.

The research team included Harald Ade, professor, and Tohru Araki, visiting assistant professor, both of the NC State Department of Physics. The team utilized the Polymer Scanning Transmission X-ray Microscopy (Polymer-STXM) at the Advanced Light Source in Berkeley, Calif., to obtain their images.

Their work was featured in the Nov. 10, 2005, issue of the *Journal of the American Chemical Society*.

PHOTO BY SALLY RAMEY

Karen Daniels holds a beaker of the type of plastic beads used in her granular flow experiments.

Shake, shake, shake your beads

In a classic case of accidental scientific discovery, Dr. Karen Daniels of the Physics Department recently made a puzzling find.

Daniels and research partner Robert Behringer of Duke University were attempting to study how round plastic beads flow over one another when shaken.

Although it sounds simple, granular flow is actually a complex phenomenon, and one that is key to understanding the movement of sand, grain, gravel and even powdered medicine—movement important to many industrial processes.

And granular flow seems inconsistent. "The Brazil Nut Effect" and the "Reverse Brazil Nut Effect" refer to how, in shaking mixtures of various-sized particles, the larger ones may rise to the top—or settle to the bottom—depending on the characteristics of the shaking.

To do their study, Daniels and Behringer filled a clear can with plastic beads. The can's bottom was spring-loaded to gently squeeze the beads. The can's lid was rotated and at the same time, the can shaken up and down. A high-speed camera was used to record the beads' motion.

"At first, I was frustrated because the beads kept freezing up on us," Daniels said. "But then I realized that we were witnessing something significant."

When shaken enough, instead of continuing to move around, the beads locked into a three-dimensional array. Despite more shaking, the beads stayed locked together.

This doesn't seem to make sense. The second law of thermodynamics holds that putting energy into anything raises its temperature and causes its particles to move about more. Therefore, the beads shouldn't lock into a non-moving, organized pattern.

Daniels thinks that this paradox may be resolved through a better understanding of the beads' temperature.

"With the right amount and kind of shaking, we may actually be lowering the beads' effective temperature and allowing them to become orderly," she said.

Hunter receives honorary degree

Dr. J. Stuart "Stu" Hunter received an honorary Doctor of Sciences degree at the 2006 spring commencement ceremony. Hunter is a pioneer in industrial experimental design and co-author of the classic statistics textbook, *Statistics for Experimenters*. Hunter is professor emeritus in Princeton's School of Engineering and Applied Science and a member of the National Academy of Engineering.

In 2004, Hunter received the PAMS Distinguished Alumnus Award. He earned three degrees from NC State—BS Electrical Engineering '47, MS Engineering Mathematics '49 and PhD Experimental Statistics in '54.

Hunter joins fellow statisticians Jim Goodnight and John Sall in receiving an honorary Doctor of Sciences degree. Goodnight (BS Applied Mathematics '65, MS Experimental Statistics '68, PhD Statistics '72), a former member of the NC State Statistics Department faculty, received an honorary degree in 2002. Sall, who conducted graduate work in the Statistics Department, received an honorary degree in 2003.

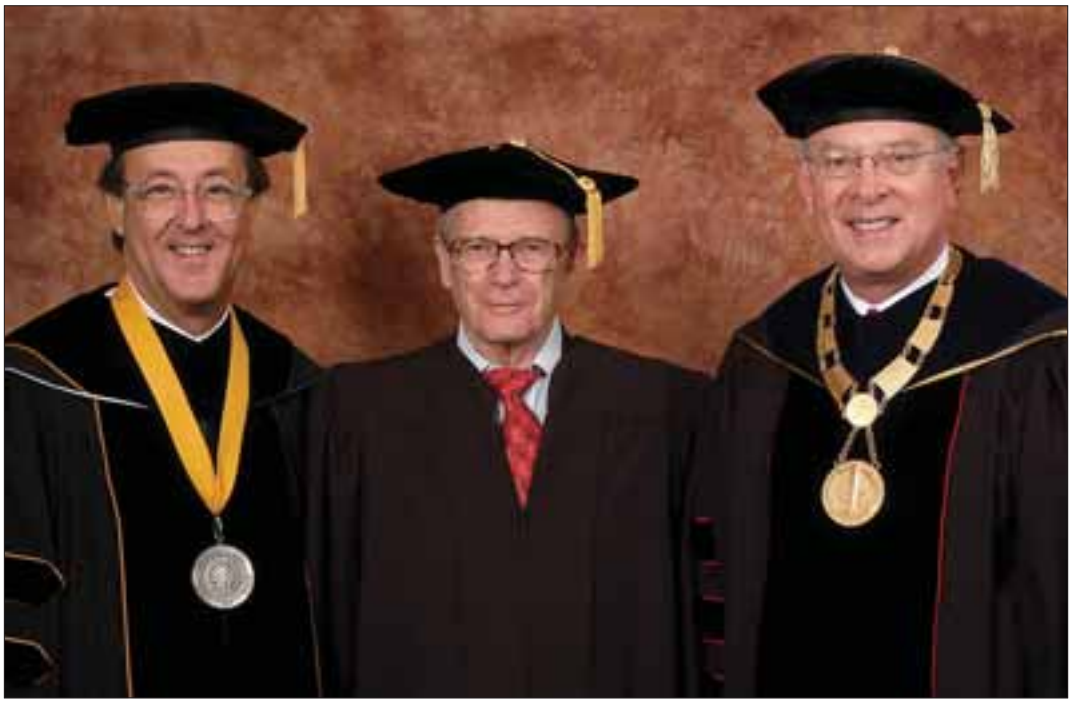


PHOTO BY ROGER WINSTEAD

UNC System President Erskine Bowles, Stu Hunter and NC State Chancellor James Oblinger

Famed string theorist presents 26th L. H. Thomas Lecture

Are atomic particles, and thus, the entire universe, really made of tiny, vibrating strings?

World-renowned physicist Brian Greene thinks so, and shared his viewpoint at the 2006 L. H. Thomas Lecture.

Presented annually by the Physics Department since 1980, the L. H. Thomas Lecture has featured the world's most prominent physicists, including 20 recipients of the Nobel Prize.

"We are very proud of the prestigious tradition maintained by the Thomas Lecture," said Michael Paesler, head of the Physics Department. "It is important for our students, faculty, colleagues and the public to have the rare opportunity to hear from the world's leading scientific minds."

Greene, a professor of physics and mathematics at Columbia University, is author of critically acclaimed *The Elegant Universe* and *The Fabric of the Cosmos*, both of which spent six months on The New York Times Best Seller List.

In addition to the L. H. Thomas Lecture, Greene presented a public lecture to a packed house at Stewart Theatre, sponsored by PAMS, the Physics Department, SAS Institute, the Union Activities Board and several other campus organizations.

Big changes at Riddick Laboratories and Jordan Hall

PHOTOS THIS PAGE BY SALLY RAMEY

Riddick Laboratories building

Jordan Hall expansion

Riddick Stadium site

When NC State says, "gutted," it really means, "gutted"

After the College of Engineering moved many of its programs to Centennial Campus, the Riddick Laboratories building was designated for the Physics Department. It was to be gutted and completely renovated. However, it was a bit surprising to see only the exterior walls left standing this spring. The Physics Department will occupy about 80 percent of Riddick, set to re-open in summer 2007.

Jordan Hall expanded

Construction is well underway on the Jordan Hall expansion, which will add about 10,000 sq. ft. for the Department of Marine, Earth and Atmospheric Sciences. The Jordan Hall project should be completed in summer 2007.

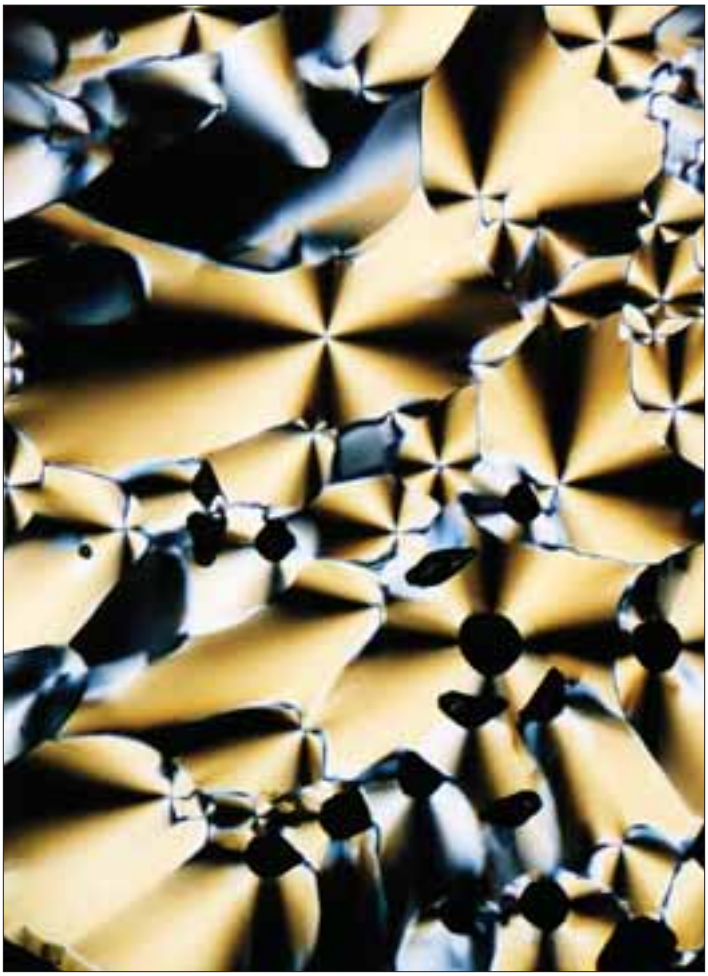
Remains of Riddick Stadium removed

This site awaits the construction of a new, state-of-the-art mathematical and statistical sciences building that will transform the old Riddick stadium area. This project is in the construction planning phase and slated for completion in fall 2008.

Chemist creates metal-rich liquid crystals

Researchers at NC State have successfully engineered liquid crystals that contain very high concentrations of metals—potentially paving the way toward the creation of "magnetic liquids" and liquid crystals that may have important ramifications for semi-conductor and solar energy research.

IMAGE BY JAMES MARTIN



The starburst-like structures are liquid crystals. The round, dark circles are bubbles.

Dr. James Martin, professor of chemistry, along with Dr. Jaap Folmer and a team of graduate students, engineered liquid crystals with an inorganic content of up to 80 percent—more than twice the ratio of previously observed organic liquid crystals with incorporated metals.

The findings appeared in the April 2006 *Nature Materials*. In fact, the work earned a prominent place as the publication's cover story. It also was featured in the April 28 issue of *Triangle Business Journal*, indicating the business community's interest in new materials.

Liquid crystals are prized for their unique optical and self-healing properties. They generally consist of toothpick- or pancake-shaped molecules that align in the liquid state because of their shape. By using electric fields to manipulate the orientation of liquid crystal molecules, scientists can control whether or not light can pass through the liquid crystalline material. Without such liquid crystals, everyday items we take for granted—such as flat-panel computer displays or LCD watches—would not exist.

The most commonly known liquid crystals are organic molecules composed of carbon, nitrogen or oxygen. Adding inorganic materials, or metals, to these liquid crystals to potentially exploit electronic or magnetic properties was problematic because the structure of these molecules made it difficult to achieve a metallic concentration high enough to be useful.

Martin's team recognized that to achieve high metal content in liquid crystals, it was necessary to start with an inorganic network from which liquid-crystalline molecules could be designed. They have achieved success with this strategy by using surfactants, like those in laundry detergent, to help engineer liquid crystalline structure from various inorganic networks. Manipulating the ratios of surfactant and inorganic components used in preparation of these materials gives the scientists a great deal of control over the structure of liquids.

The research could lead not only to the creation of new liquid crystals, but also to a new understanding of the ways in which all liquid structures—even membranes and proteins—are organized.

"Liquids are not random structures, but rather highly organized structures that we can control and shape at the atomic and molecular levels," says Martin. "When we start exploring the ways in which we can organize these liquids, we can create totally new materials and access different properties within each material."

Chinese typhoons impacted by Tibetan snow

Winter snowfall on the Tibetan plateau can influence the number and severity of typhoons the following year.

Professor Lian Xie and his colleagues in the Department of Marine, Earth and Atmospheric Sciences have made an interesting discovery about Chinese typhoons—snow in the Tibetan plateau can influence the number and severity of these dangerous storms.

Between 1976 and 1998, an average of 17 typhoons formed over the northwestern Pacific. But Xie's team found that in years where the Tibetan plateau experienced heavy snowfall, the number of storms fell to about nine. And in years of light snowfall, the number of storms rose as high as 24.

"The Tibetan plateau is like a huge elevated stove," said Xie. "Heavy snow seems to make it less efficient at warming the atmosphere."

During heavy winters, the plateau cools the air above it, which later weakens the western Pacific subtropical high-pressure system. This seems to prevent it from moving towards China, so fewer typhoons reach the Chinese coast.

Xie's research team has developed a seasonal prediction model for China's use in emergency planning and preparedness.

Science House enhances K–12 math,

A teacher from a rural NC county sat nervously in a workshop at The Science House on NC State's campus. Intimidated by the computer, she was afraid to touch the navigational mouse. But soon, she not only mastered the workshop's teaching technologies, she became an advocate for change in her school system's science and mathematics curriculum.

With support from teachers across her county, she convinced her school board to invest in computers and teaching technologies for science and mathematics classrooms—providing a valuable resource for students not found in many rural NC schools.

This is the kind of story that drives David Haase, director of The Science House and professor of physics.

"When we inspire improvement in science and math teaching in K–12 schools, we know we're doing our job," Haase said.

The Science House is the primary K–12 outreach program for PAMS. It is a national model for sustained outreach interactions between university science and mathematics departments and K–12 educators. The Science House is unusual in that it connects science research faculty with K–12 schools. Haase himself has an active research program in experimental nuclear physics.

Research shows that students begin to lose interest in math and science as early as third grade. In a recent report from the National Assessment of Educational Progress, NC fourth-graders performed at the national average on its 2005 science exam, but eighth-graders were still below average. The results from both grades haven't changed much since it was last given in 2000.

"If we are to fill the pipeline of future scientists, we have to capture their imaginations at a very young age," Haase said. "The need for effective K–12 math and science education is critical if we are to have enough scientists for the future."

Since 1991, The Science House has provided hands-on learning activities to teachers and students, including school demonstrations, laboratory technology workshops for teachers and development of learning materials. The Science House also hosts student camps on everything from algebra to photonics and environmental science.

The Science House plays a key role in large K–12 programs, such as the annual Expanding Your Horizons (EYH) program. EYH brings about 400 elementary- and middle-school girls to campus for a day of hands-on

> *"If we are to fill the pipeline of future scientists, we have to capture their imaginations at a very young age."*
>
> *—David Haase*

PHOTO BY ROGER WINSTEAD

Wake County high-school students Jonathan Butler and Khaled Amra check digital multi-meter readings from a circuit board project at The Science House.

What they say about The Science House

Unsolicited comments from teachers:

"I very much appreciate your visiting my class. Your expertise helped us imagine ways to use the equipment in our teaching and went above and beyond what I could have done on my own."

"After being trained by The Science House staff in the use of technology for data collection, I realized that it was possible to create lab activities that were exciting for the students yet met the objectives of the Standard Course of Study required by the Department of Public Instruction. I realized the possibility of replacing lecture and "cookbook" labs with inquiry-based research. My students have been afforded the opportunity to become scientists, to experience science as a process and to gain a deeper understanding of science concepts."

Comments from students:

"I didn't think we could use a computer to do science, it was amazing!"

"Science is my favorite class now."

"I learned that science isn't just a book."

science education

learning in a variety of special classes taught by female scientists from across the Triangle area.

Each year, The Science House serves about 25,000 students and 5,000 teachers. The Science House has grown to provide roughly 20 percent of all NC State K–12 outreach.

One of the primary goals of The Science House is to increase the number of students choosing STEM careers. The Science House has collected data indicating that students who participate in its programs attend college and major in STEM disciplines at a much higher rate than students without similar experiences.

For instance, 23 of 25 students (92 percent) participating in a project at Bennett's Millpond in northeastern North Carolina are attending a four-year college. This compares to an average of 54 percent of all students from this low-wealth area who attend a four-year college. Of these 23 students, 16 (70 percent) indicated plans to major in a STEM discipline, significantly higher than the national average of 21 percent, according to the 2005 SAT Profile.

"Through our programs, we ensure that K–12 teachers are prepared to teach, and that students are engaged, with appropriate methods, equipment and technologies," Haase said. "Our program has long-lasting results. We don't simply put on a quick demonstration at a school and leave—we work with teachers and schools to effect ongoing change in math and science classrooms."

The program has grown beyond what the NC State facility can handle. The Science House now has five satellite locations, strategically located across the state to efficiently serve rural school systems.

Offices are located in Asheville, Lenoir, Fayetteville, Jacksonville and Edenton. Each is staffed by an outreach coordinator who works with local school systems on teacher and student programs and provides ongoing classroom support. Research shows that such ongoing support is the deciding factor as to whether or not a teacher permanently incorporates new technology and instruction methods in the classroom.

The satellite offices make it more convenient for The Science House to provide instructional equipment and support to teachers. Equipment includes special calculators, scientific probeware, microscopes and other items.

"When a teacher brings equipment back and says it's not needed anymore, we're very happy," Haase said. "This means the equipment has become so well utilized that the teacher has convinced the school system to buy its own. That's what we want to see because it means our rural schools are obtaining the tools they need to teach more effectively."

How to support The Science House

Although it's a proven program, The Science House is primarily dependent on competitive grants to maintain its funding.

To provide a source of permanent funding, an anonymous donor introduced a matching program of up to $250,000 in endowment two years ago. Many alumni and friends took advantage of the match, and established endowments supporting The Science House totaling $500,000.

In a follow-up to this successful challenge, another anonymous donor has designated $125,000 in 1:2 matching funds for new endowments for The Science House. For example, a $20,000 pledge would be matched by $10,000, allowing the donor to establish a $30,000 endowment.

The combined total of a donor's personal gift with their corporate matching funds will also be matched by this program.

Smaller contributions are welcome and can support a general endowment fund for The Science House. For more information about making a gift, see "How to Make a Gift" on the inside back cover.

Retired faculty gather for luncheon

PHOTOS THIS PAGE BY SALLY RAMEY

Betty Finkner, Al Finkner and Vi Rigney enjoy a chance to catch up with each other.

Walter Saucier and Jerry Watson visit with each other during a social before the luncheon.

About 80 retired faculty and their guests gathered for a winter luncheon at the University Club.

This was the first event for retirees from all five PAMS departments. Participants heard brief progress reports from current department heads and Dean Dan Solomon.

For more information and a photo gallery, visit: www.pams.ncsu.edu/facultystaff/luncheon05/. You may see several familiar faces.

Bowles describes STEM strategy

PHOTO BY BECKY KIRKLAND

NC State graduate student Tim Ellis works on a laboratory project while NC State Chancellor James Oblinger, UNC System President Erskine Bowles and PAMS Dean Dan Solomon listen to another student at the Center for Marine Sciences and Technology (CMAST). PAMS conducts several research programs at CMAST, located near Morehead City.

At his inauguration as president of the University of North Carolina system, Erskine Bowles presented six areas in which the system will address STEM issues:

- Improve K–12 education
- Ensure a seamless and collaborative relationship with community colleges
- Ensure that every qualified person who wants to attend one of the system's 16 campuses can afford to do so
- Improve student retention
- Sustain our historic commitment to public service and quality research
- Attract and keep great faculty

Following are excerpts from his speech:

"... Today we look ahead with renewed faith to ponder what education will mean to the future of North Carolina; for we as a state and we as a University are facing some enormous challenges in the days ahead. All of us have seen with our own eyes the dramatic change that has occurred in North Carolina's economy because of losses on our farms and in the textile, apparel and furniture industries—industries that sustained us for generations. But as significant as these transformational changes have been to our economy, I'm afraid we haven't seen anything yet.

As Tom Friedman says in *The World is Flat*, technology has now 'wired the whole world together' and leveled the global playing field in the process. As we here in North Carolina have painfully learned, our people are no longer competing for jobs and work with just the citizens of South Carolina, Tennessee or Georgia. In today's knowledge-based global economy, we're competing head-to-head with China, India and dozens of other countries that are making tremendous strategic investments in education and research. The cold hard fact is that if we don't get more of our own people better educated, we're in a losing fight—a fight that if we shape up we can still win, and win big.

This sobering conclusion is echoed in a recent report from the National Academies called 'Rising Above the Gathering Storm.' The authors include both conservative businessmen and liberal philosophers, and unanimously they warn that the 'scientific and technical building blocks of our economic leadership are eroding at a time when many other nations are gathering strength.' They conclude that the U.S. 'must compete by optimizing its knowledge-based resources, particularly in science and technology, and by sustaining the most fertile environment for new and revitalized industries and the well-paying jobs they bring...'"

"...Far too many North Carolinians still believe that we don't have to worry about the loss of these low-skill jobs because American smarts and ingenuity will create the next new thing. They say, 'We always have, and we always will.' Well, I've got news for them. If we don't wake up and get more Americans—more North Carolinians—better educated, that next new thing isn't going to be created here. It's very likely to be invented by one of those smart folks in Asia—and that's where the new jobs of the future will be..."

"...Today's knowledge-based global economy is changing so fast and so radically, that if America and North Carolina don't wake up and get more people better educated, we will become a second-rate power before we know it. And I'm not talking about 50 years from now. I'm talking about in my lifetime. In your lifetime..."

"...Here's what your University is going to do. You can bet your bottom dollar we're not going to sit around and wait. We are going to do what your University has always done in difficult times: We are going to lead..."

"...The North Carolina of tomorrow will be better educated. It will be smarter. It will be more nimble. And as a result, our people will be able to compete—and compete successfully—with the world's best and brightest, wherever they may be..."

"Today's knowledge-based global economy is changing so fast and so radically, that if America and North Carolina don't wake up and get more people better educated, we will become a second-rate power before we know it."

—UNC System President Erskine Bowles

PAMS has voice on Capitol Hill

It's not every day one gets an invitation to testify on Capitol Hill—particularly before a U.S. Senate Committee that includes political heavyweights such as John McCain, John Kerry, Ann Hutchinson and Bill Nelson.

That's exactly what happened to Len Pietrafesa earlier this spring.

Because of his national stature in ocean and atmospheric sciences, and his federal agency-relations work as PAMS' associate dean for external affairs, he was invited to address the U.S. Senate Committee on Technology, Innovation and Competitiveness at its March 29 hearing on the Importance of Basic Research to the United States' Competitiveness.

Pietrafesa began his testimony by citing the story of Alfred Loomis, a retired, wealthy science enthusiast who supported several well-known scientists' basic research efforts. One of these efforts led to the discovery of microwave radar. Realizing what he had, Loomis immediately contacted President Franklin D. Roosevelt, who then contacted Winston Churchill.

> *"We have no birthright to global economic leadership and a high standard of living. These are things that we have to continue to earn."*
>
> *—Len Pietrafesa*

At the time, the nation was in the midst of WWII. The quickly-exploited discovery of microwave radar led to an enormous technological advantage that helped the U.S. and its allies win the war. Had it not been for the support of basic research, this discovery would not have been made at that time, and possibly not by a U.S. scientist.

"This was a very important session because the scientific community had an opportunity to present a case for increasing funding for basic research," Pietrafesa said. "There's a tendency to fund research that offers a likely probability for 'return on investment.' Basic research doesn't typically have an immediate application, yet it leads to many of the most important discoveries."

All proposed legislation involving science, engineering, and technology research, development and policy are referred to this Committee. This hearing explored how basic research in the physical sciences impacts both long-term U.S. economic development and the ability of American industry to remain globally competitive.

Specifically, the hearing provided supporting testimony for the National Innovation Act (NIA), introduced by senators John Ensign and Joe Lieberman in December 2005, as well as the Bush Administration's American Competitiveness Initiative (ACI). Both efforts are aimed to dramatically increase funding for basic scientific research, and both are being proposed for the 2007 federal budget.

NIA seeks to nearly double research funding through the National Science Foundation (NSF), encourage other federal funding agencies to commit three percent of their budgets to "frontier research" and create more graduate fellowships and traineeships to encourage students to pursue science careers.

Over 10 years, ACI seeks to double funding through the National Science Foundation, the Department of Energy's Office of Science and the Department of Commerce's National Institute of Standards and Technology (NIST).

> *This hearing explored how basic research in the physical sciences impacts both long-term U.S. economic development and the ability of American industry to remain globally competitive.*

"Such legislation will benefit research efforts across the nation and strengthen the nation's STEM initiatives," Pietrafesa said. "And as a major research university, NC State stands to benefit from the availability of more research funds."

Pietrafesa was one of two panelists representing higher education. Other panelists included representatives from the White House and private industry, and the directors of NSF and NIST.

Pietrafesa testified about the role research plays in the nation's ability to remain competitive not only in scientific fields, but also in areas such as environmental stewardship and the health and quality of life of its citizenry. His testimony included numerous examples from many fields—mathematics, statistics, physics and others, in addition to his specialty of ocean and atmospheric sciences.

He and other panelists expressed concern, and quoted many statistics from various studies illustrating that the U.S. is falling behind other nations when it comes to advances in science and technology, and the production of new scientists for the future.

"Hopefully, this Senate will recognize that…broadly supported basic research will lead to a future nation that is healthier and more economically prosperous than at present," Pietrafesa testified. "…We have no birthright to global economic leadership and a high standard of living. These are things that we have to continue to earn."

STEM grows at NC State

NC State is taking a national leadership role in the advancement of science, technology, engineering and mathematics (STEM). In the global community of today and tomorrow, these high-tech fields are the keys to jobs, opportunities and success.

Through education, research and extension efforts, NC State will:

- Build on its resources to strengthen K–12 STEM education
- Attract more students to STEM fields and prepare them to be leaders in a globally competitive future, and
- Transform lives by fueling innovations that provide solutions to 21st century challenges.

Following is a list of achievements illustrating NC State's strength in STEM programs:

- NC State offers more than 150 STEM degrees and ranks among the nation's top universities in producing STEM graduates.
- NC State produces up to half of all textiles graduates, ranks second in the number of undergraduate engineering degrees, and third in the number of all engineering degrees.
- The Department of Chemistry ranks in the nation's top 10 in the number of bachelor's degrees granted.
- The Department of Physics is the ninth largest such program.
- The Department of Marine, Earth and Atmospheric Sciences program is one of the largest interdisciplinary physical science departments.
- NC State works to increase the number of students entering STEM fields, especially among women and minorities. NC State offers dual-degree STEM programs with Meredith College, a private women's college in Raleigh, and Saint Augustine's College, a historically black college in Raleigh. In 2003 the university launched the Women in Science and Engineering (WISE) Village, a living-learning environment in which female STEM students live and study together.
- NC State ranks among the top 20 U.S. institutions in granting STEM bachelor's degrees to minority students, and third in African-American PhDs in engineering—outranking most of the nation's historically black colleges and universities. In fact, PAMS alone grants more bachelor's degrees to African-Americans than any predominantly white institution, and ranks third in the nation across all institutions. In recent years, the Mathematics Department has granted about 10 percent of the PhDs awarded to African-American women.
- NC State works to improve undergraduate instruction. The Physics Department pioneered SCALE-UP—an innovative learning environment designed for large undergraduate science classes. Combining lecture and lab, SCALE-UP organizes students into small groups that collaborate on assignments. Several schools, including the Massachusetts Institute of Technology, have adopted SCALE-UP, which improves students' problem-solving abilities, their understanding of scientific concepts and overall success rate.
- NC State strives to improve K–12 education. The Science House works in partnership with K–12 science and math teachers to increase the use and impact of technology and hands-on activities, enhancing teacher effectiveness and student learning. Each year, The Science House reaches more than 5,000 teachers and 25,000 students across North Carolina and beyond.
- NC State opens new avenues for STEM careers. Since 1980, the university has launched nearly 60 start-up companies, creating more than 13,000 jobs and more than $130 million in venture capital investments. Its technology transfer record led *The Scientist* magazine to rank the university third in the nation for greatest overall patent power.
- Across campus, STEM faculty and students produce research that will effect change for generations to come.
- NC State speaks out aggressively on STEM. Chancellor James Oblinger discusses STEM and science policy issues with business, education and community organizations and at conferences on the local, regional and national stages.

"Competing on a global level means preparing young people to take advantage of the opportunities of the future. We like to say STEM grows at NC State. As the state's flagship science and technology university, that is our mission and our responsibility."

—Chancellor James Oblinger

How can you help support STEM?

- Speak about your discipline and career to school and youth groups.
- Volunteer as a mentor or tutor in your local schools.
- Support science programs in schools, colleges, universities, museums and other science-related organizations.
- Encourage your employer to support science programs at all levels, either through financial or programmatic support.
- Write to your local and national elected representatives in support of STEM-related legislation.
- Write letters to the editor of your local paper in support of science education.
- Participate in your professional organization's STEM-related initiatives.
- Contribute toward scholarships, fellowships, faculty funds and other endowments providing financial resources to encourage more students to pursue science degrees and careers, and to provide support for current K–12 teachers. To support PAMS endowment funds, see, "How to make a gift," on the inside back cover.

Alumnus leads forensic study of New Orleans levees

It's not just in the movies that people are called out of retirement to serve their country in a time of crisis. It happened to Lewis E. "Ed" Link (Geological Engineering '68).

Link earned his MS in civil engineering from Mississippi State University in 1973 and his PhD in civil engineering from Pennsylvania State University in 1976. Link now serves as a senior research engineer on the faculty of the Department of Civil and Environmental Engineering at the University of Maryland.

PHOTO COURTESY OF ED LINK

Ed Link

Link had retired in 2002 after 34 years with the U.S. Army Corps of Engineers. At the end of his career, he was serving as director of research and development and as chief scientific adviser to the chief of engineers.

When the Corps needed someone to lead the massive research effort into the failure of the New Orleans levee system following Hurricane Katrina, the chief of engineers called Link. Since October 2005, Link has led the Interagency Performance Evaluation Task Force (IPET)—a group of more than 150 scientists, engineers and other professionals representing more than 50 government, academic and private organizations.

"It was a big challenge," Link said. "Understanding what happened was an important thing. There were places where failure could have been expected, but there were other places where the water didn't even meet the levels for which the levees were designed."

Under Link's leadership, IPET was divided into teams with specific assignments, partnering the Corps with experts from other organizations. The importance of the assignment provided so much motivation that the dedicated team members effectively maintained communications and focus.

"We were asked to do lots of work in very little time," Link said. "We also had to input our findings into the repair process as we went along, so the same vulnerabilities wouldn't be built back into the system."

Because of IPET's high profile, Link has spent a considerable amount of time speaking before Congress and other organizations closely following the research. IPET has periodically released findings over the last several months, and its final draft, released June 1, is expected to pass final external review this fall.

Link said that a fundamental finding was that when the levees were designed in 1965, engineers used the best hurricane-related data available at that time. Climate trends have drastically changed the character of today's hurricanes, and advances in technology have greatly improved the ability to study and model these dangerous storms.

"It was amazing how different the surge and wave data have become," Link said. "Our work influenced the repairs, and several of our analytical tools and models became the basis for study into how to make further improvements."

Link said that during the last few months, he has appreciated his geology education at NC State. The geology of the New Orleans area includes about 35,000 feet of Mississippi sediments. These sediments settle in complex ways, exacerbated by the removal of water and natural gas. Some levees had been sinking at a rate of about one foot per decade, while others hadn't settled at all.

© DIGITAL GLOBE

In this satellite image from Digital Globe, the dark green area is water, clearly filling the streets of the large residential area. The location of one of the levee breaches is indicated by the arrow. Lake Ponchartrain is at the top.

> *"There were places where failure could have been expected, but there were other places where the water didn't even meet the levels for which the levees were designed."*
>
> *—Ed Link*

Link hopes the nation's leaders will learn lessons from Hurricane Katrina.

"We have not made protection against natural disasters a national priority," he said. "I'm working with Congressional staff to explore new policy directions to change that. Katrina was a wake-up call for all of us."

Mathematics, Statistics research programs rise in rankings

NC State has a tradition of strong programs in mathematics and statistics. One key indicator of program strength is the degree of success in obtaining competitive research funding.

A recent study shows that research in the mathematical sciences is reaching new heights at NC State.

Preliminary National Science Foundation (NSF) data show that NC State has risen to #4 nationally in total research and development expenditures in the mathematical sciences and #6 nationally in federally financed research and development expenditures.

The NSF study combines research data from both mathematics and statistics.

Helminck named Mathematics Department head

Professor Aloysius "Loek" G. Helminck has been named head of the Department of Mathematics.

"Over the past year, during which he served as interim head, he earned the confidence and strong support of the department's faculty and staff and of the College administration," said Dean Dan Solomon. "His colleagues have been unanimous in their praise of his leadership during this period."

Helminck received his BS and MS in mathematics and physics in 1975 and 1980, respectively. He completed his PhD in mathematics in 1985. He earned all three degrees at the University of Utrecht in Utrecht, The Netherlands.

He has held visiting positions at the University of Michigan in Ann Arbor and Brandeis University in Waltham, Mass. He had research fellowships at University of Twente and Centrum voor Wiskunde en Informatica in Amsterdam, The Netherlands.

His research focus is symmetric spaces, their representations and applications.

Helminck has been a member of the Mathematics faculty since 1987 and brings to the headship a distinguished record of scholarship to complement his substantial administrative experience.

PHOTO BY ROGER WINSTEAD

Aloysius "Loek" G. Helminck

Submissions welcome for Physics Department history

Did you know that the Physics Department began with a single faculty member who also served as a professor of military science in 1894?

Or that during the 1940s, the department was primarily a teaching service constituent of the School of Engineering?

Jasper Memory and Ray Fornes have undertaken an effort to document the department's exciting evolution to its current position of prominence.

The department history will include brief biographies of key players and statements from some of them, a list of all who received a doctorate, honors given to faculty members, and an account of how the department has developed over the years.

"The department's growth has been achieved through a combination of wise and steady leadership, good decisions at critical times and a modicum of good fortune," Memory said. "It currently exhibits a strong balance in a wide variety of research areas, and preeminence in several. It is also gratifying to note that the department's strength is more widely recognized."

Other interesting facts about the department include:

The first baccalaureate degree in physics was awarded in 1925, when the department was part of the School of Science and Business.

In the late 1940s and early 1950s, NC State built the first academic nuclear reactor, and the first large research program in physics was centered around it.

The first PhDs were awarded in 1956. To date, it has awarded 270 doctorates.

In 1960, the department became part of the newly-formed School of Physical Sciences and Applied Mathematics, now the College of Physical and Mathematical Sciences.

Statements from alumni will be included in the department history. Anyone wishing to contribute material may contact Memory at jmemory@nc.rr.com.

McCollum honored for TA training program

Marilyn McCollum is one of those people who seems born to teach.

"I've always loved being in charge," said a grinning McCollum when asked to explain what drew her to teaching. "When I was in the fourth grade, the second grade teacher had to be out one day, so they picked me to be the 'teacher' until the real one got there—I know it was only for about 30 minutes, but I was the teacher and I loved it!"

Today, McCollum's love for teaching impacts virtually every student at NC State.

Director of programs for teaching assistants in the Mathematics Department, McCollum was recently honored with a Richard Felder Excellence in Teaching Award. The honor recognizes her work in creating a graduate teaching assistant (TA) training program designed to ensure success for both math students and the TAs who teach them.

PHOTO BY SALLY RAMEY

Marilyn McCollum

> *"I'm always looking for the best way to say something so that students can really get it."*
>
> *—Marilyn McCollum*

McCollum earned her master's in mathematics education and taught in public schools before joining the Mathematics Department as a lecturer in 1982. In 1985, she was put in charge of the TA training program.

From the beginning, she looked for ways to improve the program, and her education and training as a teacher enabled her to see a very obvious challenge.

"I noticed that most of the TAs didn't have educational backgrounds, or any training in classroom management," says McCollum. "So I put together a week-long 'boot camp' that took place the week before classes began. Essentially it was a mini-semester for the TAs that allowed them to practice teaching techniques, classroom management techniques—anything that would help them feel comfortable in front of a class and that would help them help their students."

McCollum created a training video on "how not to teach" that remains in use at NC State and at other institutions across the nation. In fact, McCollum's TA training program is considered a national model.

Because almost every NC State student must take at least one math course, practically the entire student body benefits from McCollum's training program.

In the early 1990s, changes in regulations called for TAs to have 18 hours of graduate courses before being allowed to teach. This in turn required the Mathematics Department to restructure its classes and the ways in which it used TAs.

"We had to use new TAs in larger lectures as recitation leaders and tutors, and rely on the experienced ones to teach the courses," said McCollum. "So the focus of the workshop shifted away from planning lessons for a particular course and toward a more student-focused model—how to answer questions and be an effective tutor. We still did classroom management, but that was secondary, because the new TAs get a year's worth of classroom experience under their belts before they have to manage their own classes."

A large part of helping students understand mathematical concepts has to do with the ways in which different students learn.

"We all have different learning styles," adds McCollum. "Richard Felder, an engineering professor here at NC State, wrote a book about learning styles describing the different ways in which students absorb knowledge. We utilize that book quite a bit—it's a real eye-opener for the new TAs to realize that not everyone comes to understand the material in the same way, and that they have to be sensitive to these different learning styles. I think it's been very helpful to both the graduate students and the undergraduates they're teaching."

The students would seem to agree.

"If the course evaluations are any indication, our TAs do just as well in the classrooms as regular faculty," said Dr. John Griggs, coordinator of classroom instruction for the Mathematics Department.

Former TAs also have praise for the training program.

"As a result of the workshops, I didn't feel like I was just being thrown in front of a classroom of 80 students," said Derek Culp, who was a mathematics TA in 2004.

Amy Langville attended the workshop in 1997. An operations research graduate student in the College of Engineering, she was assigned TA duties in mathematics.

"The workshop is unique," she said. "I know from friends who were TAs elsewhere that they received little or no training before instructing."

McCollum is committed to making sure that the TAs in front of the classrooms are well-prepared, not just for managing the needs of 30-odd undergraduates, but also for getting the lessons across.

"For me, the challenge has always been finding a way to present the material so that I'm there for the 'light bulb' moment," she said. "I love explaining, looking at faces and getting feedback, even in large lectures. I'm always looking for the best way to say something so that students can really get it."

Mathematics Department earns teaching award

All members of the Mathematics Department faculty were honored with the university's 2005–06 Departmental Award for Teaching and Learning Excellence.

Since 2000, these annual awards have honored up to two of the university's 72 departments for exceptional collective accomplishments in teaching and learning.

PAMS has quickly built an excellent record of winning this distinction. The Statistics Department won the award in 2005, and the Physics Department won the award in 2003.

Alumni help recruit students

Several PAMS alumni and friends participated in a February social for potential undergraduate students, held in the Dail Club in Vaughn Towers at Carter-Finley Stadium.

The event attracted more than 30 prospective students, and capped off a campus visitation day. Alumni and friends attending the event visited with the students and their parents.

Those attending included Cindy Clark (Statistics '76) and her husband, Joe Hackley, Tom Rhodes (Applied Mathematics '65), Benton Satterfield (Chemistry '89), John Seely (Physics '68) and his guest Janet Cave, and Bill White (Mathematics '72).

"We appreciate the participation and support of our alumni at recruitment events," said Denise Hubbard, director of development. "They are uniquely able to engage in conversations with prospective students and their parents about their own NC State experiences."

For more information and photos, visit: www.pams.ncsu.edu/society/studentrecruitment.php.

Fellowships provide vital graduate student support

John A. Ryals remembers how important his fellowship was when he was in graduate school.

"I have a PhD in molecular biology, and one of the things I needed was a stipend to help me go to graduate school," he said. Today, Ryals is CEO of Metabolon, Inc., in Durham. The company specializes in applying the field of metabolomics—the study of metabolites, such as glucose, in human cells, tissues or organs—to facilitate drug development and early diagnosis of disease.

Ryals has 20 years of experience in the biotechnology industry including senior research positions at Novartis and Ciba-Geigy and currently serves on the board of Athenix Corporation. Before joining Metabolon, Ryals was CEO, president and founder of Paradigm Genetics, Inc.

Ryals is in his second term as a member of the board of directors for the NCSU Physical and Mathematical Sciences Foundation, Inc. This nonprofit organization exists to promote and support the educational and service functions of the College.

He has also served as a member of the Bioinformatics Research Center Advisory Group.

Today's graduate students will follow in Ryals' footsteps. They will serve as tomorrow's leaders in industry, government, research, health care, public policy and education. They are the next generation of faculty that will teach today's children at colleges and universities worldwide.

Even today, graduate students are a vital part of the research process, and serve as mentors for undergraduate students in instructional and laboratory settings. They enrich the educational environment and contribute significantly to scientific discovery.

Graduate students spend another two or more years in school to earn their advanced degrees. Typically, universities provide graduate students with teaching assistant or research assistant positions so they can generate income to offset their educational costs..

However, it is fellowships that provide the stipends that allow graduate students to focus on their studies. Fellowships also cover scholarly travel, reward superior achievement and support other facets of the graduate experience.

Competition for the most talented advanced-degree students is intense on the national level and among research universities in particular. Top universities have extensive fellowship programs, and expanding graduate student support is one of PAMS' priorities in Achieve! The Campaign for NC State.

"Fellowship funds provide stipends to recruit outstanding students to our programs, while tuition support funds close the gap between in-state and out-of-state tuition, which hinders our ability to recruit the best students globally," said Anita Stallings, executive director of the PAMS Foundation. "When most people think of student support, they think of scholarships, but fellowships are just as important."

John Ryals

Today's graduate students will serve as tomorrow's leaders in industry, government, research, health care, public policy and education. They are the next generation of faculty that will teach today's children at colleges and universities worldwide.

Understanding this, Ryals has set up a fellowship with the PAMS Foundation. Established through a charitable remainder trust, the John A. Ryals Endowed Fellowship Fund will provide awards for graduate students in any of the PAMS disciplines.

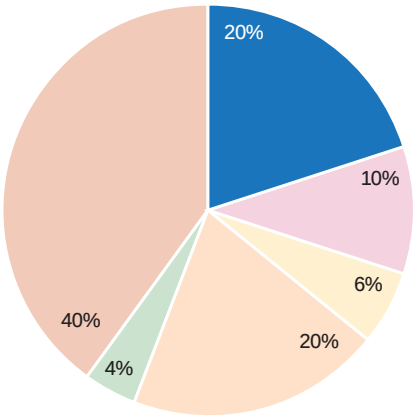
Charitable remainder trusts are established by transferring cash, securities or real estate to a trust. The funds are invested to pay income to the donor or their designees for a term of years, or their lifetimes. When the trust ends, the remaining funds pass to a designated charity and are used per the donor's original instructions. There also are tax benefits to establishing charitable remainder trusts.

"To me, it's a social responsibility. I wanted to give back to a local university," Ryals said. "It was important to me to put this together so it can benefit other students some day."

For more information about fellowship funds or charitable remainder trusts, contact Stallings at 919-515-3462, or astallin@ncsu.edu.

Achieve! The Campaign for NC State

Increasing resources to support students is an important objective of NC State's $1 billion campaign. The article on page 16 highlights the need for graduate student fellowships. At this time, PAMS is at 46 percent of its student support goal.



PAMS Campaign Goals	Endowment	Current Needs
Undergraduate and graduate student support $10 million will double the current level of support, providing resources to compete for talented students and meet financial needs	$ 6,500,000	$ 3,500,000
Faculty support $5 million will endow professorships to recruit and retain distinguished teaching and research faculty	5,000,000	
The Science House/K–12 Outreach $3 million will create an endowment to provide permanent support for The Science House, and fund current teacher training and student science programs	1,000,000	2,000,000
Facilities and equipment $10 million will leverage existing construction funds to support modern instructional methods and technologies		10,000,000
Unrestricted support $2 million in flexible, current gifts will allow us to respond to exciting opportunities, urgent needs and unexpected challenges		2,000,000
Research and Program Development $20 million will enable us to conduct research and develop academic programs leading to discoveries and knowledge that enhance quality of life and stimulate economic development		20,000,000
Total	$12,500,000	$37,500,000

PAMS Campaign Needs **$50,000,000**

How to make a gift

You may remember how difficult it was to manage the expense of higher education. You may want to help today's students achieve their dreams.

The PAMS Foundation provides many ways to support students, faculty and programs of the College. Whether you want to contribute to an existing scholarship, support a departmental enhancement fund, make a memorial gift or consider more significant support, our staff is available to help you explore the options.

To support existing funds

To contribute to a scholarship, fellowship or other fund, fill out our secure, online gift form at www.css.ncsu.edu/pams/ or mail a check to the NCSU Physical & Mathematical Sciences Foundation, Campus Box 8201, Raleigh, NC, 27695. Make checks payable to PAMS Foundation and write the name of the fund on the "notes" or "for" line.

If your employer provides matches for charitable donations, please send a completed matching gift form with your contribution.

There are many funds not mentioned in this issue of *Scope*, and several have specific designated uses. If you would like information on our various funds to help you decide the best fit for your support, please give us a call at 919-515-3462. For a list of funds, visit www.pams.ncsu.edu/development/funds.php.

To explore other options

If you have questions about gift planning, we can help you identify tax benefits, choose between permanent endowment vs. one-time support and explore estate planning or life-income options.

There are many ways to match your interests with specific College needs, and several possibilities for making your vision a reality. Whether using cash, appreciated assets, real estate or a bequest, we can help you find the best way to make the most of your gift.

Contact us today at 919-515-3462 or by e-mail at pamsalumni@lists.ncsu.edu.

PAMS Alumni & Friends Weekend 2006



Join us for the second annual PAMS Alumni & Friends Weekend, Oct. 13–14!

The weekend offers something for everyone:

- A Friday kick-off reception with fellow alumni and friends.
- Afternoon "classes" on special topics. Choose your class schedule from a variety of popular science topics.
- Friday night dinner with keynote speaker Dr. Peter J. Webster, Georgia Institute of Technology, whose research into the increasing severity of hurricanes was cited in the January 2006 issue of *Discover* magazine. *Discover* designated the topic as the #1 science story of 2005.
- The weekend coincides with the NC State-Wake Forest football game.

Mark your calendar: October 13–14!

All alumni and friends will receive more details about online registration this summer. To reserve your spot now, call 919-515-3462 or e-mail pamsalumni@lists.ncsu.edu.

scope

The College of Physical and Mathematical Sciences is made up of internationally recognized departments:

Physics
Mathematics
Chemistry
Molecular & Structural Biochemistry
Statistics
Marine, Earth & Atmospheric Sciences

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